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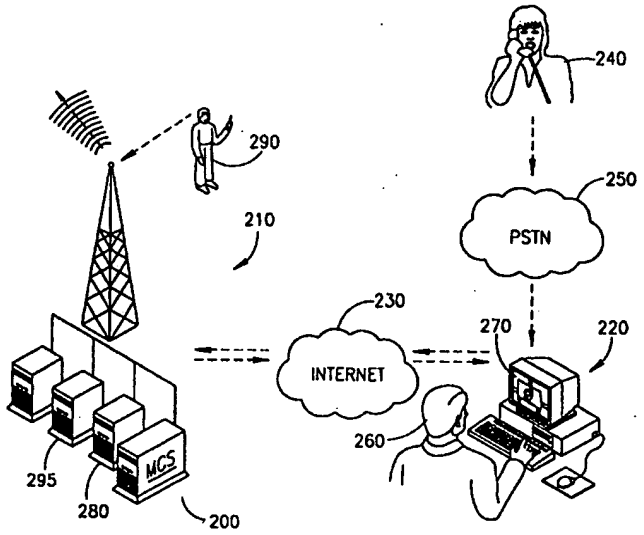

(57) Abstract

A system for managing mobile workers. The system pertains to organizations that employ mobile workers and wish to improve control over the mobile workers, increasing worker's productivity through dynamic workload allocation and job assignment. The system includes a server, installed at the central office switch of the mobile communication (Radio or Cellular) network operator, or service provider and a client system, installed at the service organization's office. The system includes a computerized system operative to: defining a current task assignment schedule to a worker, and communicating the current schedule to the worker, and automatically monitoring the worker's location during the current schedule, and correlating the monitored location with the current schedule, and selecting and reporting aspects of the correlation.

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A Method and System for Managing Mobile Workers

FIELD OF THE INVENTION

This invention relates to electronic communications and more specifically, a method and system relating to managing mobile workers.

REFERENCES

There follows a list of references that is referenced in the following description. The definitions of the terms are given for convenience of explanation and should not be regarded as binding.

1. http://www.acronymfinder.com/
2. http://www.icq.com/products/whatisicq.html
3. http://www.buymarket.com/data999/004819127.shtml
4. http://wombat.doc.ic.ac.uk/foldoc/index.html
5. http://www.techweb.com/encyclopedia
6. http://technet.microsoft.com/cdonline/default-f.asp?target=http://technet.microsoft.com/cdonline/content/complete/windows/win2000/win2ksrv/technote/disesewp.htm

BACKGROUND OF THE INVENTION

Today's Enterprise Resource Planning (ERP) Systems. large and small, have many characteristic problems in the managing of mobile workers. More

specifically, mobile workers of all trades have one thing in common, they are hard to manage. Every field service company knows the problem all too well. Once the workers are out the door there is very little control over them. And when new calls for service come in, dispatching attempts are normally sporadic and cumbersome.

As a result, idle time and inefficiency of field service workers have become an acceptable 'evil'. Notwithstanding, by prevailing consensus, it directly affects the organization's operational profit margins, levels of service and customer satisfaction.

Field service organizations of all trades lack one thing in common, a standards-based workforce management solution. Over the years different solutions were introduced in the market to cope with the inefficiencies of mobile workforce management. Some were software oriented back office solutions for scheduling and optimization, while others were GPS (Global Positioning System) enabled fleet management solutions. Problem is they were all proprietary solutions by nature, expensive and complicated to implement. Effectively, only the top leading service organizations in each industry had the vision and the means to implement advanced integrated solutions of this kind.

Companies and organizations that operate mobile workforces utilize manual or computerized planning programs to schedule their workers' job assignments and time- tables. Current procedures entail in-advance scheduling of job assignments, normally triggered by requests for service or routine maintenance requirements. Usually the work itinerary is provided to the field worker each day for the next day/s and on his return he is expected to report on the results.

Same-day changes to the field worker's itinerary require cumbersome and costly dispatching procedures. The dispatcher needs first to conduct a search for the field worker, confirm his location and job status and then

converse with him, by telephone or radio communication, before altering his daily itinerary.

Two main problems readily arise from the inability to control and manage dynamically changes in the workflow of their mobile workforces:

1. Undesired level of service provided to customers, reflecting on the organization's reputation and competitive position.
2. Poor productivity level of field workers, reflecting on the organization's labor overheads and bottom line profitability.

There is a clear need amongst substantially, all service organizations to be able to better control worker's job status and whereabouts. Manual search and verification procedures of a mobile worker's location and job status were proven to be exhaustive to dispatchers and, moreover, foremost ineffective. A centralized, technology based, location and communication system could automate search and verification procedures and enable data-oriented fast and economical dispatching techniques.

Notwithstanding the aforesaid description, there are many existing components that may successfully contribute to a system for managing mobile workers. For example, each of the following US patents teaches a potentially indispensable component for the building of a system for managing mobile workers: 5155689, 5299132, 5388147, 5398190, 5513111, 5519621, 5652707, 5682421, 5799061, 5831519, and 5835061. Furthermore, there are many commercially available components, which may contribute to the building of a system for managing mobile workers. More information about such commercially available components, manufactured by various companies, can be accessed, utilizing the following list of WWW-addresses. It should be noted that the list does not constitutes completeness.

http://www.signalsoftcorp.com/;

http://www.ericsson.se/SE/epk/mpc/docs/mpsfaq.html;

http://www.ericsson.se/Eripress/19981105-0039.html;

http://www.trueposition.com/tdoa.htm;

http://www.geo.ed.ac.uk/home/giswww.html;

http://www.atm.co.il/msl98.htm; or

http://www.jya.com/cell-track.htm.

Surprisingly, even with essentially all of the indispensable components necessary for the building of a system for managing mobile workers available, and indeed, with the clear need in today's ERP Systems, a facile method for managing mobile workers has not been forthcoming.

SUMMARY OF THE INVENTION

For convenience of explanation, the term MCS (Mobile Command System) is used in below description.

This invention pertains to organizations that employ mobile workers, wish to improve control over them and increase worker's productivity through dynamic workload allocation and job assignment. The invention assumes that the organization currently employs a computerized customer database and, or work planning, or customer interaction software. In addition, it is assumed that field workers are, or will be equipped with a cellular, or radio, telephone or terminal as a communication means, or the like.

The system of the preferred embodiment of the present invention is a software-based solution for mobile workforce management. It includes two software-based modules operating under Client / Server architecture.

The first module is the server program, installed at the central office switch of the mobile communication (Radio or Cellular) network operator, or service provider. The second module is the client program, installed at the service organization's office. Both client and server software can be offered as a software suite, to be integrated within existing computerized systems. Alternatively, the software suite can be offered together with hardware to be integrated or interfaced with third party equipment.

Once these two software modules are in place, one out of many possible scenarios is the following proceeding:

- A service call is received via the telephone, the Internet, or in person.
- The service agent accesses the "present invention" client program and commands a search for the field workers in a general, or specifically defined geographical area.
- The "present invention" client program initiates a data query to the "present invention" server program, which in turn triggers a location query to the network operator's system. The operator's system, utilizing base-station location information, identifies the location of designated cellular / radio subscribers in relationship to the base-station they are currently covered by.
- Once location information is obtained, the "present invention" server transmits the data to the "present invention" client, where a digital map is displayed with the field workers location appearing in the form of icons. Provided integration with organization's information system, each icon can actively display any information related to the field worker's details, schedule, etc.
- The service agent selects the appropriate field worker to perform the job.
- The service agent types a data message at the "present invention" client, containing all pertinent job information, and transmits it to "the present invention" server.
- The "present invention" server communicates the data message to the network operator's SMS (Short Message Service) or other data transmission system

- The field worker receives the data message, originated at the service agent "the present invention" client, to his cellular, or radio, telephone / terminal.
- Subject to the prevailing business rules and, or availability of two way data messaging over the network, the field worker can confirm, reject, or comment by sending back a data message to the agent's "the present invention" client, through the "present invention" server.

It is appreciated that the above-described proceedings can equally well be performed automatically with no human (service agent) intervention.

By implementing the "present invention" system several problems are solved:

- A service organization will no longer need to search for his workers through manual, voice communication based, dispatching techniques.
- Through the "present invention" client, it can rather control, in real time, the location of multiple field service workers instantaneously, upon request.
- Unlike with other location technologies, i.e. GPS, radio devices, etc. utilization of cellular location techniques, requires no installation of special positioning and communication equipment, thus reducing dramatically the cost and complexity of the solution.
- By enabling two-way data messaging workers can report job status in real time, updating dynamically and automatically corporate information files.
- Circumventing time consuming and expensive voice communications, data communication is fast, precise and cost

effective. (Many cellular operators are currently providing it even free of charge).

The present invention has many advantages over current solutions.

- Current solutions involve the installation of special (proprietary or dedicated) equipment on the field worker's end, to determine location.
- The "present invention" system utilizes the wireless network to retrieve a subscriber's location, based on the mobile terminal routine signaling, with no extra hardware devices.
- Current solutions involve manual voice communication dispatch methods. The "the present invention" system offers integrated, location triggered, data messaging methods for fast, economical and efficient dispatching.
- Utilizing a client on the enterprise communication network side and a server on the side of the wireless network's central office switch provides for seamless communication integration, and most reliable data transmission applications.

In the context of the present invention, a mobile worker may be an individual journeyman, a work crew, or a team having individuals, crews, foremen, etc. For example, a plumber may be a mobile worker, an electrician and his assistant may be a mobile worker, a road repair crew may be a mobile worker, or even a single dispatch of fire-fighting equipment, ambulances, police, and crisis management personnel may be a mobile worker.

According to the preferred embodiment of the present invention, the present invention relates to a method for managing a mobile worker, the method including the steps of:

(a) defining a current task assignment schedule to a worker; and

(b) communicating the current schedule to the worker; and

(c) monitoring automatically the worker's location during the current schedule; and

(d) correlating the monitored location with the current schedule; and

(e) selecting and reporting aspects of the correlation.

According to the preferred embodiment of the present invention, the current task assignment schedule is modified and the modification to the current schedule is communicated to the worker. The "current task assignment schedule" is either as defined in step (a) or as herein modified.

According to one embodiment of the preferred embodiment, modifying the current task assignment schedule is effected automatically. According to another embodiment of the present embodiment, the modification is negotiated with the worker. Alternatively, both of these embodiments can be combined into another embodiment. In some mobile worker management contexts it may be preferable to give first preference to automatic modification and thereafter to accept schedule change objections from the worker. In other mobile worker management contexts it may be preferable to give first preference to the worker's perspective on accepting modifications to his own schedule.

According to the preferred embodiment of the present invention, the defining (step (a)) is using relational database-like rules. Alternatively, there may be hierarchies of rules which are applied to the defining, such as considering costs, priorities, worker skills, available tools, schedules for delivery of parts, etc. As a method for use with mobile workers, according to the preferred embodiment of the present invention the defining, or modifying of a current task assignment schedule (step (a)) is optimized for minimum travel.

Furthermore, according to one aspect of the present invention, the modified current task assignment schedule is using a priority grade for the task assignments and therein is optimized for minimum travel. According to

another aspect of the present invention, the modification to current schedule is communicated to the worker.

Thus, the communicating (step **(b)**), reporting (step **(e)**) and the communication of modification to current schedule utilize, but are not limited to, *inter alia*:

1. email,
2. facsimile,
3. cellular telephone voice channel,
4. cellular telephone signal channel (Short Message Service),
5. internet www interactive website,
6. VOIP (Voice Over Internet Protocol [1]) telephony,
7. IDEN (Integrated Digital Enhanced Network (Motorola variant of TDMA wireless) [1] -type digital radio,
8. posting to a media to which the worker has access, such as *inter alia*:
   - **(A)** a chart pinned to a bulletin board,
   - **(B)** work order authorization or request sent by messenger,
   - **(C)** oral statement,
   - **(D)** presentation at a meeting,
   - **(E)** various internet posting platforms (private or closed chat-, usergroups-, ICQ-like-, and based upon ICQ- applications).

(ICQ – "I seek you" – ICQ Inc.: ICQ is an Internet tool that informs who's on-line at any time and enabling contact at will. Mode of communication can be freely chosen, regardless of application, be it chat, voice, message board, data conferencing, file transfer or Internet games, the entire message is transferred in real time [2]).

In addition, the communicating (step **(b)**) is in digital form. "Digital form," in the context of the present invention, relates to digitized packet containing a part of a task assignment schedule, format information for the schedule, or transactions relating to the schedule. These digitized packets are

transmittable with the highest efficiency over today's electronic communications systems.

Furthermore, the communicating (step **(b)**) includes transmission of *inter alia:*

a. voice,

b. data,

c. printed material,

d. graphics,

e. maps,

f. codes,

g. video, or/and

h. multimedia.

According to the preferred embodiment of the present invention, the communication includes a content redundant combination of at least two of the aforesaid. For example, the communication may be a voice instruction describing a modification in the schedule, and the voice instruction is sent with a map and with a text work-order, breaking down the entire new item in the schedule according to task, skills, tools, parts, identification and reference numbers, etc.

According to the present invention, the monitoring is accomplished by *inter alia* :

1. cellular telephone cell based locating of the worker and the worker maintains a proximate cellular telephone,
2. querying the worker and recording the worker's location response, or
3. querying a GPS monitor and the worker maintains a proximate GPS monitor.

In this context "proximate" may be on the worker, in the worker's toolbox, in the worker's vehicle, or with the worker's team foreman. Similarly, there are many different levels of location precision that may be

required in actual applications. For example, in dispatching a road repair crew, it may be sufficient to know that they are in the cellular telephone cell where the work needs to be done. On a construction site, however, it may be important for management monitoring to know the location of each worker to within a few meters. When high precision location knowledge is important, locating includes the use of triangulation or cell intersection, in the cellular telephone locating context or precise known *per se* triangulation GPS locating, in the GPS locating context.

According to the preferred embodiment of the present invention, the monitoring (step **(c)**) is done periodically, according to anticipated location changes indicated in the current task assignment schedule, randomly, or upon management query. According to the preferred embodiment of the present invention, the monitoring (step **(c)**) is done at each occurrence of the worker reporting or transacting with management, or upon the turning on a worker's communications unit, or upon each occurrence of a worker's communications unit entering a new communications cell. In this context, the "communication unit" may be the mobile worker's cellular telephone/pager, two-way radio, or the like.

According to the preferred embodiment of the present invention, the correlating (step **(d)**) discovers location violations from the current task assignment schedule, measures accuracy of the current task assignment schedule, or/and measures the worker's productivity against a current standard of productivity for each assigned task. Furthermore, the selecting (step **(e)**) is using relational database-like rules.

As a method for use with mobile workers, according to the preferred embodiment of the present invention the defining, or modifying of a current task assignment schedule (step **(a)**) is optimized for minimum travel.

According to the preferred embodiment of the present invention, the correlating (step **(d)**) is represented on a map. This map may then be of use

to a dispatcher, or to a manager. The map may be stored digitally or may be rendered as a physical document.

Furthermore, the present invention relates to a method for managing a plurality of mobile workers. This method for managing a plurality of workers includes managing each mobile worker according to the method as heretofore defined, wherein the plurality of current task assignment schedules is using a priority grade for the task assignments and a worker qualification grade for each worker.

In addition, the present invention relates to a distributed system for managing a plurality of mobile workers using the method as heretofore defined, the system including three types of situated apart, interconnected modules:

I. at least one client application module for:
   (a) defining a current task assignment schedule to a worker,
   (b) communicating the current schedule to the worker,
   (d) correlating the monitored location with the current schedule,
   (e) selecting and reporting aspects of the correlation, or
   (f) modifying the current task assignment schedule;

II. at least one server application module for:
   (b) communicating the current schedule to the worker,
   (c) monitoring automatically the worker's location during the current schedule,
   (d) correlating the monitored location with the current schedule, or
   (e) selecting and reporting aspects of the correlation; and

III. at least one worker application module, wherein each module is associated with a communication unit and wherein there is a predefined transaction format between any pair of modules.

Note that the reference letters, (a) through (e) correspond to steps in the method, and that there is an optional assignment of functions (b), (d) and (e) to either module (I) or (II).

According to the preferred embodiment of the system of the present invention, transactions between the modules include a common GIS (Geographic(al) Information System [1]) location description for the worker and his task assignment. Furthermore, according to the preferred embodiment, location descriptions for the worker and his task assignment are represented graphically on at least one map.

According to the preferred embodiment of the system of the present invention, fulfilling of a customer request for visitation by a task qualified mobile worker includes: the client application recording the visitation location by using customer query response, using a customer registration, or by using a query response of an accessible database; the client application searching for at least one qualified mobile worker who is presently near the vitiation location or whose task assignment schedule will locate said at least one qualified mobile worker near the visitation location; and the search is conducted using records of the client application or using a last known location for workers accessible from the server application. Furthermore, according to the preferred embodiment, the client application selects worker for task assignment scheduling to the visitation location.

According to one aspect of the present embodiment, the client application conveys worker-customer direct communication information to either the worker or to the customer. Alternatively, according to another aspect of the present embodiment, the client application negotiates, with the worker or with the customer, adding of the visitation to the workers task assignment schedule. As in the method of the present invention, there are embodiments that allow these aspects to overlap.

According to the preferred embodiment of the system of the present invention, the client application opens a virtual session at the server application, and provides the server application with automatic rule based monitoring and reporting instruction logic.

According to the preferred embodiment of the system of the present invention, the client application module or the server application is divided into two interactive portions, one portion located at a processor of a client and the other portion at a server of a network, and a predetermined transaction protocol binding the two portions. According to one aspect of the present embodiment, the portion located at the processor of the client in substantially restricted to simple input and output transactions. According to another aspect of the present embodiment, the portion located at the processor of the client maintains a substantially current download of data from the server application. Likewise, since the system of the present invention may simultaneously relate to clients of different preferences, these aspects may overlap.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, a preferred embodiment will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic diagram showing the main components of the Mobile Command System.

Fig. 2 is a schematic diagram showing the components of the Mobile Command System in more detail.

Fig. 3 is a schematic chart showing the Mobile Command System architecture.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

For convenience of explanation the invention is described below with reference to a preferred embodiment, which constitute a cellular enabled mobile command system for mobile workforce management.

Those versed in the art will readily appreciate that the invention is by no means bound to this embodiment and the examples described herein and that a multitude of variations and applications are within the scope of the present invention.

The Mobile Command System was developed to allow intelligent mobile workforce management through standard cellular data communication and information technologies. The system features a unique, rule-based, process (according to the present invention) which provides on-demand real time location information and 2-way SMS messaging. Through this process the system also enables the implementation of automatic event notification from the field based on a user-defined set of enterprise business rules.

The solution is comprised in three main system components, with reference to Fig. **1**:

a network based server **100**; and

a remote client software application **110**; and

a cellular phone/pager **120**.

Turning now to fig. **2**, server **200** resides at the cellular operator's MSSC (Mobile Services Switching Center) **210** while the client software is installed commonly at the service organization's office. The remote client workstation **220** communicates efficiently with the server **200** via an Internet connection **230.**

There follows now a brief discussion describing a possible scenario wherein a preferred embodiment of the present invention is utilized:

1. A customer's call **240** comes in via, commonly a PSTN (Public Switched Telecommunications/Telephone Network [1]) **250.**

2. The customer service representative **260** is presented with a map **270** with the customer's location in the center of map **270** by the client software on the remote client workstation **220**.
3. Then, remote client workstation **220** queries server **200** for the current location of designated worker/s **290** in the customer's vicinity, utilizing location module **280**, part of MSSC **210**.
4. Once a qualified worker was selected for the job, a dispatch message via internet-based SMSC (Short Message Service Communicator) **295** appears in seconds directly on his cellular phone.
5. The worker can reply in return, by a key–stroke, from an assortment of customized messages stored in his cellular phone, or by free alpha–numeric input.
6. Optionally, using his cellular phone, the field worker can also browse his company's Web for additional product or customer information.

Cellular operators can now offer new differentiating, value added Business services. Tying in lucrative corporate customers by the core of their business.

In today's cellular business arena competition is primarily marked by discounted rates and marketing packages. Operators are constantly searching for differentiation through value added services. Most, though, provide very similar value added services, such as Voice mail, caller ID, etc.

With the Mobile Command System, cellular operators are able to offer a new line of value added services: application oriented business services. application oriented business services are business services that have significant impact on the very core of a corporate customer's business and help elevate individual productivity and control over its field service operations.

The lucrative markets of service organizations and mobile professionals represent a significant segment in the cellular communication

industry not the least on account of these customers representing by definition 'heavy communication users', utilizing their cellular phones as a "mission critical" business tool. Thus, unlike regular consumers, these customers are less interested in savings

Aimed at field service organizations of all sizes, the MCS is easy to implement, by virtue of its modular configuration.

The MCS solution involves three elements, all offered to the customer by the cellular operator:

A. Cellular phones for the use of mobile workers.

B. Subscription to the operator's MCS location and 2-way messaging services.

C. Easy to install, MCS client software, including Geographical Information System (digital map) and a basic mobile workforce management application. Open API (Application Program(ming) [1]) Interface and JAVA (a general purpose, high-level, object-oriented, cross-platform programming language developed by Sun Microsystems [1]) interfaces are available for seamless integration with Help-desk / Enterprise Management software applications.

Applicants are confident that the system of the present invention will significantly change the field service management paradigm.

Tangible, measurable benefits make the Mobile Command System a significant solution to common and awkward situations:

A. With no up-front investments, field service organizations can immediately start exploring the advantages and benefits of real-time workforce monitoring and 2-way data messaging services.

B. Providing substantially instant monitoring and data communication with mobile workers through basic, standard devices and applications. This significantly contributes to higher efficiency levels of dispatchers and

greater productivity of field workers. Thus achieving more jobs being handled, per worker, per day or, in financial terms, improved profitability.

c. Generating an estimated total monthly cost, per mobile worker, instrumental for obtaining substantive productivity gains.

There follows now a brief discussion on the architecture of the present invention with reference to Fig. 3.

The Mobile Command System (MCS) Client/Server architecture consists of two main components: the MCS server **300** and the MCS client **305**. The MCS server is connected to the cellular operator LAN (Local Access Network, or Local Area Network [1]). The MCS client is a remote application that communicates with the MCS server via the Internet.

The MCS server is preferably, a multi-tier distributed application, such as e.g. the Windows DNA model (Distributed interNetwork Architecture [1]) of *inter alia,* presentation tier, business logic tier and data tier, which can physically distribute processing over a multitude of computers for scalable, manageable and maintainable server applications. The MCS server runs preferably, on a Microsoft Windows NT (New Technology [1]) server, utilizing an internal database engine, such as the MICROSOFT - BACKOFFICE® SQL SERVER ENTERPRISE ED V7.0 (Clustering model), offered by *inter alia,* CODE Micro Systems, 770 Sycamore Avenue, J-108, Vista, CA 92083, USA [3].

The MCS client is preferably offered in two configurations:

i. iMCS - a thin client, WEB (entanglement or mesh in context with the World Wide Web – WWW, an Internet client-server hypertext distributed information retrieval system which originated from the CERN High-Energy Physics laboratories in Geneva, Switzerland [4]) based HTML (Hyper Text Markup Language [1]) application, providing location information, two-way data messaging and mobile workforce management facilities. Field workers' location is presented on a raster map, retrieved from the server.

II. eMCS - a rich client for the enterprise, containing a vector map engine and communicating with the server via a COM (Component Object Model [1]) interface over HTTP (Hyper Text Transport Protocol [1]).

The Mobile Command System Server **100** (Fig. 1) comprises of the following components:

I. MCS Database

The MCS database server is preferable Microsoft SQL7 (SQL - Structured Query Language [1]).

The database in general holds the following information:

(i) Service subscribers,

(ii) Mobile phone information,

(iii) Location information,

(iv) Profiles,

(v) Rules and Actions,

(vi) Security and Logs.

II. MCS Database Service

The database service role is to act as a database interface i.e. a set of functions that are used to manipulate the fields of each of the database tables by other components on the server.

III. SMSC Gateway

The SMSC **295** gateway is the gate used by the SMS Service to send and receive SMS messages. The gateway doesn't contain any business logic but is simply used as communication component to the provider's SMSC, packaging the messages in a defined format prior to transmission and filtering the received messages before transferring them back to the SMS service. The gateway is logically divided into 2 complimentary units (Transmit/Receive), each unit manages an internal message queue. Only the SMS Service can access the SMSC Gateway.

IV. SMS Service

The SMS Service, part of the SMS Module **310**, is used by other components in the server to send / receive SMS messages. The SMS Service contains all the logic necessary for dealing with several different message sources and types.

V. Location Gateway

The Location Gateway uses several methods to access location information, which can be combined, if required:

(i) Cell/Sector based location, obtained by a special STk application,

(ii) HLR/VLR (Home Location Register/ Visitor Location Register [1]), and

(iii) Location Servers.

VI. Location Service

The Location Service is used by other components in the server to access mobile telephone's location information. Substantially, all location requests are sent via the Location Gateway, part of the Location Module **315**.

VII. Billing Service

The Billing Service role is to read database log, at predefined times and generate billing data for the cellular operator's Billing Gateway (BGW), part of the Billing Module **320**.

VIII. Rule-based Engine

The Rule-based Engine, using a dedicated rule-based processor **325**, automatically monitors a worker's location and verifies it against current scheduled tasks, enterprise business rules and, or management restrictions. If a rule has been violated, a notification action is being taken according to a predefined set of actions.

IX. Rule-based Service

The Rule-based Service provides an interface to MCS clients in order to set / modify rules. It also provides the necessary services to the Rule-based Engine for executing actions upon rules violations.

x. Request Service

The Request Service, part of the Request Handler **330**, acts as a general client interface and therefore offers a wide variety of actions based on user login rights.

After completing the authentication phase each user request is tested against user permissions retrieved from the internal database and transferred to the defined component for execution. An answer to a client request is returned via a special event mechanism.

xi. Supervisor Application

The Supervisor application is used for administrative tasks.

Such tasks may include adding new customers, adding new workers, constructing various reports, setting general rules, server maintenance, etc.

xii. Security

The MCS server services are obtained using a DCOM (Distributed Component Object Model [1]) secured interface over HTTP. Using the HTTP protocol as a carrier enables the server and the client to comply with standard security issues such as using a FIREWALL (a method for keeping a network secure; it can be implemented in a single router that filters out unwanted packets, or it may use a combination of technologies in routers and hosts [5]).

The current authentication implementation **335** supports preferably the NTLM (Microsoft Windows NT LAN Manager [1]) protocol and the SSL (Secured Socket Layer – Netscape [1]). With the release of NT5 the KERBEROS protocol will be preferably supported as well.

There follows now a brief clarification of the above mentioned terms KERBEROS, NTLM, SSL, and STk:

- KERBEROS (authentication system of the Project Athena, developed at Massachusetts Institute of Technology, Cambridge, MA, USA.). The Kerberos authentication protocol is a mature industry standard that has advantages for Windows network authentication of both client and server and delegation of authorization from clients to servers through the use of proxy mechanisms. The Kerberos Version 5 authentication protocol replaces NTLM as the primary security protocol for access to resources within or across Windows 2000 domains. Some of the benefits of Kerberos protocol are mutual authentication of both client and server, reduced server load during connection establishment, and support for delegation of authorization from clients to servers through the use of proxy mechanisms [6]. It is based on symmetric key cryptography. Adopted by OSF as the basis of security for DME. OSF (Open Software Foundation) is a foundation created by nine computer vendors, (Apollo, DEC, Hewlett-Packard, IBM, Bull, Nixdorf, Philips, Siemens and Hitachi) to promote "Open Computing" [4].
- The NTLM authentication protocol is the password-based authentication protocol for Microsoft Windows based networking. Microsoft® Windows NT® Server offers superior security services for account management and enterprise-wide network authentication. Windows NT LAN Manager (NTLM) authentication protocol is used by Windows NT 4.0 and previous versions of Windows NT. [6].
- The Secured Socket layer (SSL) **340** (Fig. 3) is the de facto standard today for connections between Internet browsers and Internet Information Servers. An IETF (Internet Engineering Task Force [1]) standard protocol definition based on SSL3 is forthcoming and is currently known as the

Transport Layer Security Protocol (TLS). This protocol makes use of public-key certificates to mutually authenticated clients and servers.

- STk (scheme interpreter for Tk) expresses all of Tk as Scheme objects. Tk is a GUI library, generally used with TCL, but also available from within C or Perl. Tk is available for X Window System, Microsoft Windows and Macintosh. TCL (Tool Command Language), is an interpreted string processing language for issuing commands to interactive programs, developed by John Ousterhout at the University of California at Berkeley, CA, USA [4].

The present invention has been described with certain degree of particularity. Those versed in the art will readily appreciate that various modifications and alterations may be carried out without departing from the scope of the following claims:

CLAIMS:

1. A method for managing a mobile worker, the method comprising the steps of:
   (a) defining a current task assignment schedule to a worker; and
   (b) communicating the current schedule to the worker; and
   (c) monitoring automatically the worker's location during the current schedule; and
   (d) correlating the monitored location with the current schedule; and
   (e) selecting and reporting aspects of the correlation.

2. The method according to claim 1 wherein the current task assignment schedule is modified and the modification to the current schedule is communicated to the worker.

3. The method according to claim 2 wherein modifying the current task assignment schedule is effected automatically.

4. The method according to claim 2 wherein the modification is negotiated with the worker.

5. The method according to claim 1 wherein the defining is using relational database-like rules.

6. The method according to claim 1 wherein the communication is by email, facsimile, cellular telephone voice channel, cellular telephone signal channel (SMS), internet, VOIP telephony, IDEN-type digital radio, or by posting to a worker accessible media.

7. The method according to claim 1 wherein the communicating is in digital form.

8. The method according to claim 1 wherein the communicating includes transmission of voice, data, facsimile, graphics, map,

codes, a compressed representation of any of the aforesaid, any combination of the aforesaid, or a content redundant combination of at least two of the aforesaid.

9. The method according to claim 1 wherein the monitoring is by cellular telephone cell based locating of the worker and the worker maintains a proximate cellular telephone, by querying the worker and recording the worker's location response, or by GPS locating of the worker and the worker maintains a proximate GPS monitor.

10. The method according to claim 9 wherein locating includes triangulation or cell intersection.

11. The method according to claim 1 wherein the monitoring is done periodically, according to anticipated location changes indicated in the current task assignment schedule, randomly, or upon management query.

12. The method according to claim 1 wherein the monitoring is done at each occurrence of the worker reporting or transacting with management, or upon the turning on a worker's communications unit, or upon each occurrence of a worker's communications unit entering a new communications cell.

13. The method according to claim 1 wherein the correlating discovers location violations from the current task assignment schedule, measures accuracy of the current task assignment schedule, or measures the worker's productivity against a current standard of productivity for each assigned task.

14. The method according to claim 1 wherein the selecting is using relational database-like rules.

15. The method according to claim 1 wherein the reporting is by: email, facsimile, cellular telephone voice channel, cellular

telephone signal channel (SMS), internet, VOIP telephony, IDEN-type digital radio, or by posting to a worker accessible media.

16. The method according to claim 1 wherein the defining of a current task assignment schedule is optimized for minimum travel.

17. The method according to claim 2 wherein the modified current task assignment schedule is optimized for minimum travel.

18. The method according to claim 2 wherein the modified current task assignment schedule is using a priority grade for the task assignments and therein is optimized for minimum travel.

19. The method according to claim 2 wherein the modification to current schedule is communicated to the worker using: email, facsimile, a cellular telephone voice channel, a cellular telephone signal channel (SMS), internet, VOIP telephony, IDEN-type digital radio, or by posting to a worker accessible media.

20. The method according to claim 1 wherein the correlating is represented on a map.

21. A method for managing a plurality of mobile workers comprising managing each mobile worker according to the method as defined in any of claims 1-20 wherein the plurality of current task assignment schedules is using a priority grade for the task assignments and a worker qualification grade for each worker.

22. A distributed system for managing a plurality of mobile workers using the method as defined in any of claims 1-21, the system comprising three types of situated apart, interconnected modules:

(I) at least one client application module for:

(a) defining a current task assignment schedule to a worker; and

(b) communicating the current schedule to the worker; and

(d) correlating the monitored location with the current schedule; and

(e) selecting and reporting aspects of the correlation, or

(f) modifying the current task assignment schedule;

(II) at least one server application module for:

(b) communicating the current schedule to the worker; and

(c) monitoring automatically the worker's location during the current schedule; and

(d) correlating the monitored location with the current schedule, or

(e) selecting and reporting aspects of the correlation; and

(III) at least one worker application module, wherein each module is associated with a communication unit and wherein there is a predefined transaction format between any pair of modules.

23. The system according to claim **22** wherein transactions between the modules include a common Geographical Information System (GIS) location description for the worker and his task assignment.

24. The system according to claim **23** wherein location descriptions for the worker and his task assignment are represented graphically on at least one map.

25. The system according to claim **22** wherein fulfilling of a customer request for visitation by a task qualified mobile worker includes: the client application recording the visitation location by using customer query response, using a customer registration, or by using a query response of an accessible database; the client application searching for at least one qualified mobile worker

who is presently near the vitiation location or whose task assignment schedule will locate said at least one qualified mobile worker near the visitation location; and the search is conducted using records of the client application or using a last known location for workers accessible from the server application.

26. The system according to claim 25 wherein the client application selects worker for task assignment scheduling to the visitation location.

27. The system according to claim 26 wherein the client application conveys worker-customer directs communication information to either the worker or the customer.

28. The system according to claim 26 wherein the client application negotiates, with the worker or with the customer, adding of the visitation to the workers task assignment schedule.

29. The system according to claim 22 wherein the client application opens a virtual session at the server application, and provides the server application with automatic rule based monitoring and reporting instruction logic.

30. The system according to claim 22 wherein the client application module or the server application is divided into two interactive portions, one portion located at a processor of a client and the other portion at a server of a network, and a predetermined transaction protocol binding the two portions.

31. The system according to claim 30 wherein the portion located at the processor of the client in substantially restricted to simple input and output transactions.

32. The system according to claim 30 wherein the portion located at the processor of the client maintains a substantially current download of data from the server application.

33. For use in the system of Claim 22, a client application module.

34. For use in the system of Claim 22, a server application module.

35. For use in the system of Claim 22, a worker application module.

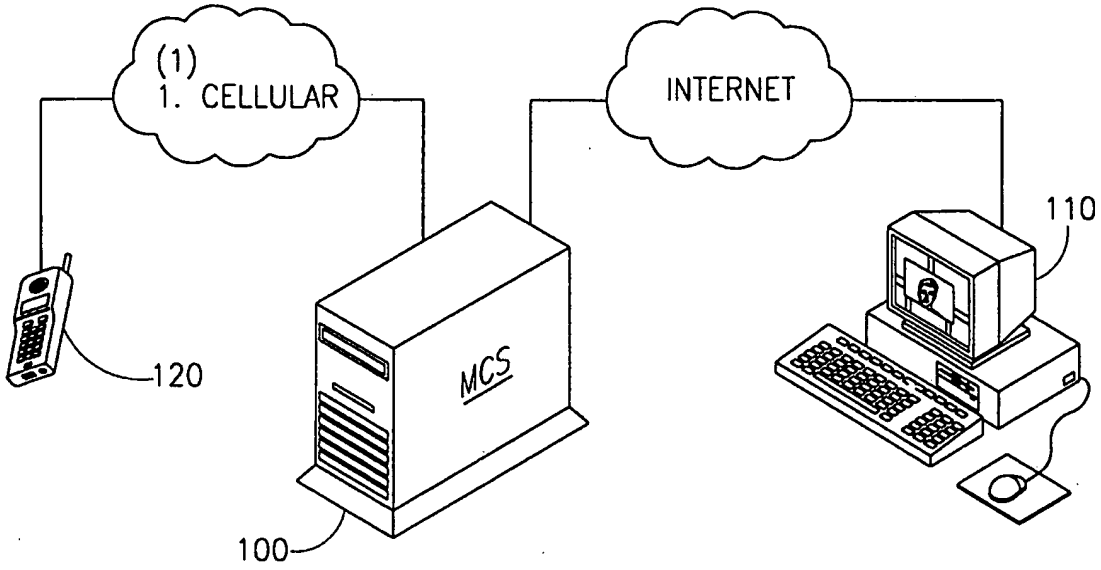
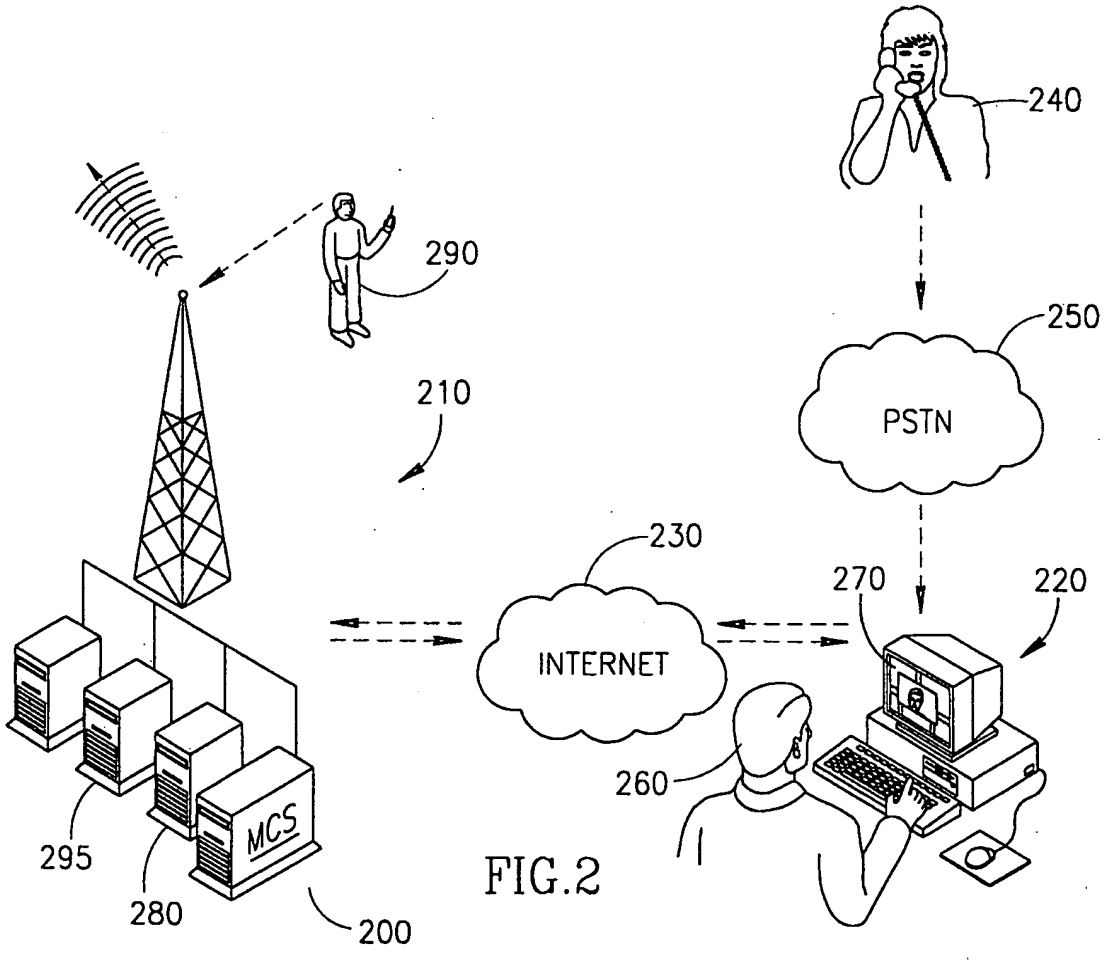

(1)
1. CELLULAR
INTERNET
110
120
MCS
100

FIG.1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250
PSTN
210
230
270
220
INTERNET
260
295
280
MCS
200

FIG.2

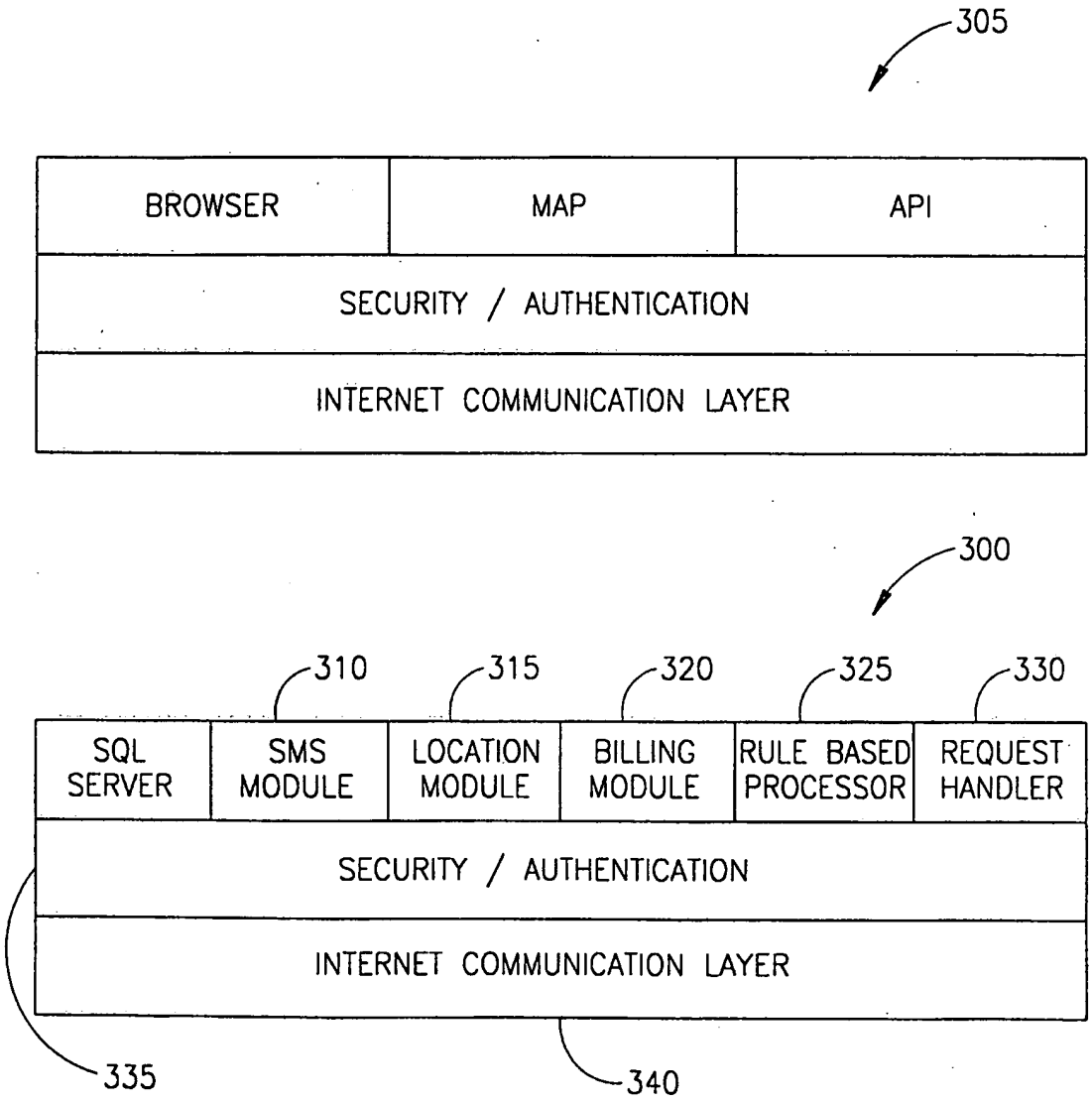
305
BROWSER
MAP
API
SECURITY / AUTHENTICATION
INTERNET COMMUNICATION LAYER
300
310
315
320
325
330
SQL SERVER
SMS MODULE
LOCATION MODULE
BILLING MODULE
RULE BASED PROCESSOR
REQUEST HANDLER
SECURITY / AUTHENTICATION
INTERNET COMMUNICATION LAYER
335
340

FIG.3